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Research performed in collaboration with George Mason University, the University of California at Berkeley, and Berkeley Research Associates in order to develop a freely-available, re-usable, object-oriented PIC code in C++. The code should have a state-of-the-art graphical user interface (GUI) and physics capabilities such as a fully relativistic and electromagnetic field solver, variable geometries (cylindrical, cartesian, etc.), a multi-conductor package, extensive diagnostics, etc. The code will have extensive documentation.

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1996 Final Technical Report

AN OBJECT-ORIENTED PARTICLE-IN-CELL CODE

F49620-93-C-0005

by

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Research Objectives:

Perform research in collaboration with George Mason University, the University of California at Berkeley, and Berkeley Research Associates in order to develop a freely-available, re-usable, object-oriented PIC code in C++. The code should have a state-of-the-art graphical user interface (GUI) and physics capabilities such as a fully relativistic and electromagnetic field solver, variable geometries (cylindrical, cartesian, etc.), a multi-conductor package, extensive diagnostics, etc. The code will have extensive documentation.

Status of research effort:

This research effort is a collaborative effort between FM Technologies, the University of California at Berkeley, George Mason University, and Berkeley Research Associates. Thus, the project status reflects the work of all the researchers. The particular responsibilites of FM Technologies, Inc. in this effort is to provide overall support for integration of the code among the various groups, testing of OOPIC, and management of (and scientific consultation to) the effort at George Mason University.

During the no-cost extension to the final report, FM Technologies was involved in the following major activities:

- Management, support, and scientific consultation to the GUI developer, Dr. James Acquah.
- Physics Code Development
- Manual writing, editing, and development

These issues are discussed in detail in the following sections.

Management, Support, and Scientific Consultation to the effort at GMU:

During the no-cost extension, FMT's prime goal was to ensure development of a 32-bit version of PC OOPIC which was as bug-free and reliable as possible. FMT was able to impact the GMU contract by:

- Helping to keep the chief GUI designer, James Acquah, employed at GMU so as to be able to sustain the development of the GUI.
- Purchasing software needed for GUI development and testing for GMU.
- Aiding in communication, and interfacing with the physics developers on the West Coast and the GUI developers at GMU.

Physics Code Development:

Improved the FieldEmitter Boundary in collaboration with John Verboncoeur of UC Berkeley. Developed a number of new input decks, the most important being a deck for which a TEM wave is injected into a coaxial cavity which feeds into an rf cavity. The TEM wave mode-converts to a TM_{01} mode. Part of the cavity is made up of a field-emitter which field emits when subject to the TM_{01} electric field. This input deck thus simulates a high-power diode.

Manual Writing, Editing, and Development:

FMT is responsible for the documentation of the code. During this period we completed the development of a World Wide Web version of the Users Manual, Developers Manual, and the Algorithm Manual. Because this is a "new-generation" PIC code, an online manual version was considered appropriate by AFOSR technical supervisor, Dr. Robert Barker.

The on-line Web site for the OOPIC manuals is:

http://ptsg.eecs.berkeley.edu/~peter/manuals.html